THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

DEVELOPMENT OF A MANUFACTURING PROCEDURE FOR LOW-LITHIUM, LOW-URANIUM CONTENT FILTER PAPER

Project 3101

Report Thirteen

A Status Report

to

DEPARTMENT OF THE AIR FORCE
1155th TECHNICAL OPERATIONS SQUADRON (HQ. COMD.)
McCLELLAN AFB, CALIFORNIA

July 16, 1974

TABLE OF CONTENTS

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

DEVELOPMENT OF A MANUFACTURING PROCEDURE FOR LOW-LITHIUM, LOW-URANIUM CONTENT FILTER PAPER

SUMMARY

The process of leaching by percolation was applied to a stack of 21 sheets, each 20 inches square, of IPC-1478 paper, Series N (without Kronisol). The purified paper was then treated with Kronisol and 20 sheets were submitted to McClellan AFB, MCL-C, for analysis and testing. The uranium content was generally well below the goal sought (< 0.3 ng U/g), and the lithium content indicated that > 90% of the lithium, originally present, had been removed. The Kronisol content, 16-24% based on the weight of paper after extraction, was uneven, and less than 30% sought.

Captain Frank Grosso and Mr. Jack Phelps visited the Institute on June 19, 1974, to review the status of Project 3101.

INTRODUCTION

Efforts were made during this period to evaluate the process of leaching by percolation for the purification of IPC-1478 paper, Series N. Preparations are under way to improve the efficiency of the process in order to supply the laboratory at McClellan AFB with larger amounts of treated paper.

In accord with the requirements of the contract for Project 3101, a final detailed report for the year ending June 30, 1974, has been started.

On June 19, 1974, Capt. Frank Grosso and Mr. Jack Phelps visited The Institute of Paper Chemistry, Appleton, Wis. The status of the work on Project 3101 was reviewed, and general plans were made for the possible continuation of the project for the period July 1, 1974 to June 30, 1975.

DISCUSSION

Based on the experience gained in the purification of IPC-paper, Series N (1), a batch of twenty-one sheets (20 x 20 inches) was leached with ammonium carbonate and hydrofluoric acid in two cycles, and the sheets were sprayed individually with Kronisol. One sheet was retained by the Institute for a Kronisol determination, and the remainder were sent to McClellan AFB, MCL-C, for analysis and testing. The analytical results are summarized in Tables I and II, and in Fig. 1.

As shown in Fig. 1 the distribution of lithium was reasonably uniform with little if any pattern or trend. The sheets retained 7-9% of the lithium (uncorrected for Kronisol) originally present in the paper. These results are somewhat higher than those (approximately 4% retention) for Samples 346 and 347 achieved by a similar process.

The data in Table II were obtained from scraps obtained in cutting 16-inch circles from the remaining 18 sheets. Throughout the lot, the lithium contents were relatively uniform and the uranium contents were less than the goal sought (< 0.3 ng U/g). The 8/5 ratios, together with the uranium contents, suggest that much of the original uranium (8/5 = 116) in the pulp had been exchanged for uranium (8/5 = 137) in the process water.

Department of the Air Force
1155th Technical Operations Squadron (Hq. Comd.)
McClellan AFB, California
Project 3101

TABLE I

ANALYSIS OF PURIFIED IPC-1478 PAPER, SERIES N,
IPC SAMPLE 3101-350[a]

Sample No.	Uranium 8/5	Uranium ng/g	Lithium, ng/g
7445-3101-294	126	0.644	23.4
7445-3101-350			
A-1	108	0.128	2.48
A-2	119	0.101	2.49
A-3			2.15
A-4			1.48
A-5			1.79
A-6			1.62
A-7			2.51
A-8			2.57
			Av. 2.13
B-1			1.85
B-2			1.17
B-3	130	0.116	1.53
B-4			2.90
B-5			1.31
B-6			1.54
B-7			1.74
B-8			1.60
			Av. 1.71

[a]See Reference (2).

TABLE II

ANALYSIS OF PURIFIED IPC-1478 PAPER, SERIES N,
IPC SAMPLE NO. 3101-350
CUTTINGS FROM PRODUCTION OF 16-INCH CIRCLES[a]

Sample No.	Uranium 8/5	Uranium ng/g	Lithium, ng/g	Kronisol, % of paper after extraction
7445-5505				
1/1	129	0.100	1.91	24
1/2	131	0.095	1.98	
1/3	131	0.077	1.46	18
1/4	127	0.125	1.89	
1/5	135	0.301	1.67	17
1/6	120	0.073	1.19	
1/7	129	0.093	1.64	
1/8	132	0.115	1.78	20
1/9	134	0.126	1.93	
1/10	131	0.079	1.59	16
1/11	135	0.098	1.84	
1/12	134	0.102	1.65	21
1/13	135	0.129	1.47	
1/14	134	0.111	1.46	
1/15	134	0.217	1.63	20
1/16	136	0.202	1.47	
1/17	137	0.277	2.75	
1/18	136	0.164	1.40	22
Av.	132	0.138	1.67	

[a] See Reference (2).

Sheet A

A-1 2.48	A-5 1.79	A-4 1.48
A-6 1.62	A-2 2.49	A-7 2.51
A-8 2.57	A-9 --	A-3 2.15

Sheet B

B-1 1.85	B-5 1.31	B-6 1.54
B-7 1.74	B-2 1.17	B-8 1.60
B-4 2.90	B-9 --	B-3 1.53

Figure 1. Lithium Contents in ng/Li g of Two 20-Inch Squares of Purified IPC-1478 Paper, Sample 3101-350 [see Reference (2)]

FUTURE WORK

A final report for the year's work ending June 30, 1974, will be due on or before September 30, 1974.

An extension of Project 3101 is currently anticipated. Upon receipt of the new contract, work will be started on: (a) the purification of Series N paper in 20-inch squares, and (b) further work to improve the efficiency of purification processes.

Department of the Air Force
1155th Technical Operations Squadron (Hq. Comd.)
McClellan AFB, California
Project 3101

EXPERIMENTAL

350. PURIFICATION OF IPC-1478 PAPER, SERIES N, IN TWENTY-INCH SQUARES

A. Leaching Platform

A square platform, 24 x 24 inches was made of plywood (5/8-inch) with 1 3/8-inch sides to hold a polyethylene sheet in the form of a shallow tray. A rubber stopper (no. 4) carried a short piece of 3/8-inch polyethylene (PE) tubing as a drain at the center of the tray. Although the stopper formed a liquid-tight seal with the PE sheeting, the tray could not be sealed with a rubber sheet to press water from the stack of paper.

B. Purification of Series N Paper

Twenty-one 20-inch squares (730 g) of paper were cut from IPC-1478 paper, Series N, Roll No. 22. The stack of paper was placed on four similar squares of the Hercules PS-57 pulp and topped with nine squares of the same pulp. The entire stack of pulp and paper was placed on a neoprene rubber mesh mat. The stack was topped with a similar square of matting and the stack was weighted with 20 kg of weights supported on a grid of Lucite strips. The stack was leached by percolation in succession with 8 liters of 0.1M ammonium carbonate, 10 liters of water, 8 liters of 0.1M hydrofluoric acid, and 18 liters of water (until neutral to Congo Red paper). The paper was dried in filtered air, the stacks was reassembled, and the leaching cycle was repeated except that the final wash required 20 liters of water.

Each dry, purified square of paper was sprayed with approximately 10 g of Kronisol, one sheet was retained for a Kronisol determination, and the remainder

were packaged and shipped to McClellan AFB, MCL-C, as Sample No. 350. Analytical data are summarized in Fig. 1 and in Tables I and II.

KRONISOL DETERMINATION

Strips of the IPC-1478 paper, 3-4 cm x 10-12 cm, were rolled loosely and placed in pyrex extraction tubes (14 mm ID x 65 mm in length equipped with a stem, 5 mm OD x 80 mm in length). The sample was carefully leached with acetone added from a capillary-tipped (1 mm) transfer pipet until 10-12 ml of extract had been collected in a tared beaker. Upon evaporation of the solvent in air, the Kronisol was determined gravimetrically. The Kronisol content was expressed as percentage of solvent-free oil based on the weight of paper determined as the difference between the weight of the original paper and the extracted oil:

$$\frac{\text{weight of extracted oil} \times 100}{(\text{weight of paper as received} - \text{weight of oil extracted})} = \text{percent Kronisol.}$$

The data are recorded in Table II.

LITERATURE CITED

1. Project 3101, Report Twelve, May 3, 1974, 4 p.

2. The data were supplied in a letter dated June 25, 1974, from Capt. Frank Grosso to E. E. Dickey.

THE INSTITUTE OF PAPER CHEMISTRY

Edgar E. Dickey
Senior Research Associate
Division of Natural
Materials & Systems

Irwin A. Pearl
Group Coordinator
Division of Natural
Materials & Systems